



NASA STTR 2004 Phase I Solicitation

T1 Ames Research Center

NASA Ames Research Center is located at Moffett Field, California in the heart of Silicon Valley. Ames was founded December 20, 1939 as an aircraft research laboratory by the National Advisory Committee for Aeronautics (NACA) and in 1958 became part of National Aeronautics and Space Administration (NASA). Ames specializes in research geared toward creating new knowledge and new technologies that span the spectrum of NASA interests.

Subtopics

T1.01 Information Technologies for System Health Management, Autonomy and Scientific Exploration

Lead Center: ARC

Information technology is a key element in the successful achievement of NASA's strategic goals. Modern tools and techniques have the capability to redefine many design and operational processes, as well as enable grand exploration and science investigations. This subtopic seeks innovative solutions to the following information technology challenges:

- Onboard methods that monitor system health and then automatically reconfigure to respond to failures and sustain progress toward high-level goals. Special emphasis will be on computational techniques for coordinating multi-agent systems in the presence of anomalies or threats.
- Onboard, real-time health management systems that perform quickly enough to monitor a flight control system (including spacecraft and fixed or rotary wing aircraft) in a highly dynamic environment, and respond to anomalies with suggested recovery or mitigation actions.
- Integrated software capabilities that allow automated science platforms, such as rovers, to respond to high-level goals. This could include perception of camera and other sensor data, position determination and path planning, science planning, and automated analysis of resulting science data.
- Data fusion, data mining, and automated reasoning technologies that can improve risk assessments,

increase identification of system degradation, and enhance scientific understanding.

- Techniques for interconnecting and understanding large heterogeneous or multidimensional data sets or data with complex spatial and/or temporal dynamics.
- Computational and human/computer interface methodologies for inferring causation from associations and background knowledge for scientific, engineering, control, and performance analyses.
- Software generation tools that capture designer intent and performance expectations and that embed extra knowledge into the generated code for use by automated software analysis tools doing validation and verification, system optimization, and performance envelope exception handling.
- Tools and techniques for program synthesis and program verification of high-assurance software systems.
- Innovative communication, command, and control concepts for autonomous systems that require interaction with humans to achieve complex operations.

T1.02 Space Radiation Dosimetry and Countermeasures

Lead Center: ARC

As NASA embarks on a new Exploration agenda, the study of the space radiation environment and its effects on living things and support technologies will be critical for the success of long-term missions. Our current understanding of the space radiation environment, particularly high atomic number and energy particles (HZE particles) and energetic protons, and its interaction with materials, technological systems, and living things is limited compared to our understanding of gamma and x-rays. NASA has established a space radiation laboratory at Brookhaven National Labs capable of generating HZE particles and protons, and supports a facility at Loma Linda University Medical Center capable of generating energetic protons to enable research studies. We seek innovative technology solutions in the following areas:

Advanced Dosimetry Systems

- Real time dosimetry providing dose and particle types and energies for use onboard spacecraft and planetary habitats
- Real-time and cumulative dosimeters for characterizing space environments, including planetary surfaces
- Alarm systems for Solar Particle Events
- Microdosimetry for research applications including implantable dosimeters for biological studies

Radiation Hardened Electronic Systems

- Methods for hardening pre-existing technologies

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- Novel materials and circuit design

Shielding Materials and Systems

- Multi-use materials for spacecraft and habitat fabrication (high strength, high shielding characteristics, embedded dosimetry, or warning devices)
- Materials for advanced EVA suits
- Alternative non-materials based shielding technologies

Life Support Systems Composition and Monitoring

- Technologies to monitor the composition and health of biological components (microbial and plant) of life support and bio-remediation systems
- Development of radiation resistant organisms for life support and bio-remediation systems

Biological Markers of Human Radiation Exposure

- Identify markers of radiation damage that can be obtained in a minimally invasive manner
- Technological systems to identify and quantitate biological markers onboard spacecraft and planetary habitats

Astronaut Health Countermeasures

- Pharmaceuticals to counteract the deleterious effects of space radiation exposure
- Gene therapy and other biological approaches
- Markers for genetic susceptibility to space radiation damage